Gas Leakage Detector

Electronic fixed gas leak detectors

CAREL

(ENG) **User manual**

High Efficiency Solutions

IMPORTANT

CAREL bases the development of its products on decades of experience in HVAC, on the continuous investments in technological innovations to products, procedures and strict quality processes with in-circuit and functional testing on 100% of its products, and on the most innovative production technology available on the market. CAREL and its subYESdiaries nonetheless cannot guarantee that all the aspects of the product and the software included with the product respond to the requirements of the final application, despite the product being developed according to start-of-the-art techniques.

The customer (manufacturer, developer or installer of the final equipment) accepts all liability and risk relating to the configuration of the product in order to reach the expected results in relation to the specific final installation and/or equipment. CAREL may, based on specific agreements, act as a consultant for the poYEStive commisYESoning of the final unit/application, however in no case does it accept liability for the correct operation of the final equipment/system.

The CAREL product is a state-of-the-art product, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the webYESte www.CAREL.com.

Each CAREL product, in relation to its advanced level of technology, requires setup / configuration / programming / commisYESoning to be able to operate in the best possible way for the specific application. The failure to complete such operations, which are required/indicated in the user manual, may cause the final product to malfunction; CAREL accepts no liability in such cases.

Only qualified personnel may install or carry out technical service on the product.
The customer must only use the product in the manner described in the documentation relating to the product.

In addition to observing any further warnings described in this manual, the following warnings must be heeded for all CAREL products:
- Prevent the electronic circuits from getting wet. Rain, humidity and all types of liquids or condensate contain corroYESve minerals that may damage the electronic circuits. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
- Do not install the device in particularly hot environments. Too high temperatures may reduce the life of electronic devices, damage them and deform or melt the plastic parts. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
- Do not attempt to open the device in any way other than described in the manual.
- Do not drop, hit or shake the device, as the internal circuits and mechanisms may be irreparably damaged.
- Do not use corroYESve chemicals, solvents or aggressive detergents to clean the device.
- Do not use the product for applications other than those specified in the technical manual.

All of the above suggestions likewise apply to the controllers, serial boards, programming keys or any other accessory in the CAREL product portfolio. CAREL adopts a policy of continual development. Consequently, CAREL reserves the right to make changes and improvements to any product described in this document without prior warning. The technical specifications shown in the manual may be changed without prior warning.

The liability of CAREL in relation to its products is specified in the CAREL general contract conditions, available on the webYESte www.CAREL.com and/or by specific agreements with customers; specifically, to the extent where allowed by applicable legislation, in no case will CAREL, its employees or subYESdiaries be liable for any lost earnings or sales, losses of data and information, costs of replacement goods or services, damage to things or people, downtime or any direct, indirect, incidental, actual, punitive, exemplary, special or consequential damage of any kind whatsoever, whether contractual, extra-contractual or due to negligence, or any other liabilities deriving from the installation, use or imposYESbility to use the product, even if CAREL or its subYESdiaries are warned of the posYESbility of such damage.

IMPORTANT

WARNING: separate as much as possible the probe and digital input signal cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance. Never run power cables (including the electrical panel wiring) and signal cables in the same conduits.

The product must be installed with the earthconnected, using the special yellow-green terminal on the terminal block. Do not use the neutral for the earth connection.

DISPOSAL

INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

In reference to European Community directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:
1. WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. the public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment.
3. the equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
4. the symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
5. in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

Warranty on the materials: 2 years (from the date of production, excluding consumables).

Approval: the quality and safety of CAREL INDUSTRIES Hqs products are guaranteed by the ISO 9001 certified design and production system.

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Content

1. INTRODUCTION

1.1 Description

DPWL* represent a range of electronic fixed gas leak detectors with LED indicators for Power and Alarm. They have direct output relays, as well as voltage and current outputs and Modbus communication.

They are designed for detection of refrigerant leaks to the atmosphere in Coldrooms, Freezer rooms, Plantrooms, plant enclosures, and other areas where refrigeration plant is likely to be located.

The refrigerant gas leak sensor is a device that signals leakages of common gases (R22, R134a, R404a, R407a, R407c, R410a, R290, NH3, Ethylene and CO2). It can be used in stand-alone applications, or integrated into Carel controllers or third party devices. Connection to Carel controllers is made using an analogue or digital output or Modbus® RS485 serial connection. When leaks are detected exceeding a certain concentration, the sensor sends an alarm signal to the controller, activating a local audible and visual warning and a relay (SPDT).

This allows prompt identification of gas leaks, avoiding having to shut the unit down and at the same time guaranteeing the safety of any people in the vicinity.

Each model is calibrated for a specific gas and is typically installed in new or existing buildings that require continuous monitoring of gas leaks. Installation of the device ensures compliance with European standards F-GAS and EN378 as well as ASHRAE 15.

Available in semiconductor or infrared version with enclosure IP41 and IP66 built-in and with remote sensor.

1.2 Codes

The Gas Detector is available in two sensor versions: **Semiconductor (SC)** for refrigerants and **infrared (IR)** for CO2 **and with remote sensor and cable 5m.**

Semiconductor (IP41)	Semiconductor with 5 m remote sensor (IP66)	Descrizione
DPWLA07000	DPWLA27000	R22 gas leak detector
DPWLB07000	DPWLB27000	R134a gas leak detector
DPWLC07000	DPWLC27000	R404a gas leak detector
DPWLR07000		R407a gas leak detector
DPWLD07000	DPWLD27000	R407c gas leak detector
DPWLS07000		R407f gas leak detector
DPWLE07000	DPWLE27000	R410a gas leak detector
DPWLG07000		NH3 gas leak detector
DPWLQ07000		ETHYLENE gas leak detector
DPWLP07000		R290 gas leak detector

Infrared (IP41)	Infrared (IP66)	Infrared with 5 m remote sensor (IP66)	Descrizione
DPWLK07000			R134a gas leak detector
DPWLL07000			R404a gas leak detector
DPWLM07000			R407a gas leak detector
DPWLN07000			R410a gas leak detector
	DPWL417000	DPWL427000	CO2 gas leak detector

Options:

6133015AXX	"HCFC, HFC and ETHYLENE refrigerant gas sensor for semiconductor version
6133017AXX	HCFC, HFC and ETHYLENE refrigerant gas sensor for semiconductor version cable 5m
6133019AXX	"NH3 and R290 refrigerant gas sensor - for semiconductor version"
6133016AXX	CO2 refrigerant gas sensor - for infrared version
6133018AXX	CO2 refrigerant gas sensor - for infrared version cable 5m
DPWLKIT000	Calibration adapter (hose and hood)
DPWLKIT010	Calibration adapter (hose and 4 hoods)
DPWLKIT100	Protection against water spray for IP66 version

Tab. 1.a

1.3 Calibration requirements

Local standards may require control procedures for sensor calibration. The main relevant standards require testing and calibration at least once a year.
The semiconductor sensors are calibrated for a specific gas. The first calibration is performed by the manufacturer, subsequent calibrations are performed by the installer.

1.4 Maintenance

Annual testing	Tests must be performed annually to meet EN378 and F-GAS standards
Every 3 years	Calibration recommended
Every 5/6 years	Gas sensor replacement and calibration recommended

Tab. 1.b

⚠ Check local regulations on calibration or testing requirements.

After exposure to a substantial gas leak, element sensor should be checked and replaced if necessary.

Note: following a significant gas leak with extended exposure, check and if necessary replace the sensor.

1.5 Technical specifications

	Semiconductor version R22, R134a, R404a, R407c, R410a, R290, NH3, Ethylene	Infrared version CO$_2$	Infrared version R134A, R404a, R407a, R410a
Power supply:	12/24V+20% dc/ac 50/60 Hz		
Power consumption (at 12V):	153mA,	136mA	
Monitoring active:	Green LED		
Alarm display:	Red LED		
Audible alarm:	enabled/disabled		
Fault during monitoring:	Red LED ON - Green OFF		
Fault status:	1V, 2mA	1V, 2mA	
Analogue output:	0-5V, 1-5V, 0-10V, 2-10V, 4-20mA		
Serial communication:	Modbus® RS485		
Digital output:	1 relay rated at 1 A/24 Vdc/ac		
Selectable delay:	0, 1, 5, 10min		
IP protection:	IP41 built-in version IP66 remote sensor version	IP66 built-in and remote sensor	
Typical operating range:	0-1,000 ppm	0-10.000 ppm	
Operating conditions:	-20T50°C	-40T50°C	-20T50°C
Non-condensing humidity:	0 to 95%		
Estimated sensor life:	5-8 years		
Alarm threshold	100 ppm	1500 ppm	100 ppm
Reset time	600 s	210 s	
Linearity	on calibration field		
Operating range:	• HCFC = 10 to 1,000 ppm (semiconductor vers.)		
	• HFCs =10 to 1,000 ppm (semiconductor vers.)		
	• Carbon Dioxide = 0 to 10,000 ppm (infrared vers.)		

Tab. 1.c

1.6   Dimensions and mounting

Version IP44

Mounting

Fig. 1.a

Dimensions

Fig. 1.b

Version IP66

Mounting and Dimensions

mounting measurements

mounting slots =
9mm long x 6mm wide
use 5mm - 6mm screws

Fig. 1.c

Version IP66 with remote sensor

mounting measurements

mounting slots =
9mm long x 6mm wide
use 5mm - 6mm screws

Fig. 1.d

2. INTRODUCTION

2.1 Display functions

On powering up it will sense for the presence of gas, after an initial warm-up delay of 5 minutes.
In alarm condition:
• the green LED stays on
• the red LED will be on
• the siren operates (if it has not been disabled and after a delay if this option has been selected)
• the relay output activates (after a delay if this option has been selected)
• the voltage or current output changes proportional to gas concentration.

Fault condition:
• the green LED will be go off
• the red LED will be on
• the siren does not operates
• the relay does not activates
• a voltage or current fault output will activate
• 2mA on the 4-20mA output
• 0.5V on the 1-5V output
• 1V on the 2-10V output

2.2 Modbus connections

Connector CN4 is the RS-485 communications port providing access to the Modbus-RTU protocol, for communicating with the Carel DPWL gas detectors. A+ is the non-inverting data signal, B- is the inverted data signal and 0V is the board ground plane. **See Cap. 3**

2.3 Setting the communications Baud Rate

To choose a communications baud rate, select either address 254 or 255 and reset the gas detector by removing jumper J4 or by cycling the power on and off.
Address 254 SW1: E SW2: F Baud rate 9600 (Factory Default)
Address 255 SW1: F SW2: F Baud rate 19200

After the unit has been powered up the desired Modbus address (1-247) can be selected. For more information see paragraph 4.2.

2.4 Location of Sensors

Sensors must be located within the appropriate wire lengths from the central control unit (if used).
In all cases the sensor supplied is designed for maximum sensitivity to a particular gas.

However, in certain circumstances false alarms may be caused by the occasional presence of sufficiently high concentrations of other gaseous impurities.
Examples of situations where such abnormalities may arise include:
• Plant room maintenance activity involving solvent or paint fumes or refrigerant leaks.
• Plant rooms in fruit ripening/storage facilities because of accidental gas migration (bananas – ethylene, apples – carbon dioxide)
• Heavy localised exhaust fumes (carbon monoxide, dioxide, propane) from engine driven forklifts in confined spaces or close to sensors.

A response delay may be selected to minimise any problems that might arise or change the alarm set point.

2.5 Machinery rooms

There is **NO ABSOLUTE RULE** in determining the number of sensors and their location. However a number of simple guidelines will help to make a decision.

Sensors monitor a point as opposed to an area. If the gas leak does not reach the sensor then no alarm will be raised. Therefore, it is extremely important to carefully select the sensor location. Also consider ease of access for maintenance.

The size and nature of the site will help to decide which method is the most appropriate to use. Locations requiring the most protection in a machinery or plant room would be around compressors, pressurised storage vessels, refrigerant cylinders or storage rooms or pipelines. Most vulnerable are valves, gauges, flanges, joints (brazed or mechanical), filling or draining connections etc

When mechanical or natural ventilation is present mount a sensor in the airflow.

In machinery rooms where there is no discernable or strong airflow then options are:
• Point Detection, where sensors are located as near as possible to the most likely sources of leakage, such as the compressor, expansion valves, mechanical joints or cable duct trenches.
• Perimeter Detection, where sensors completely surround the area or equipment.
• With heavier than air gases such as halocarbon and hydrocarbon refrigerants such as R404A, propane, and butane sensors should be located near ground level
• With similar density or miscible gases, such as CO_2, sensors should be mounted about head high – say 1.5m.
• Sensors should be positioned a little way back from any high-pressure parts to allow gas clouds to form. Otherwise any leakage of gas is likely to pass by in a high-speed jet and not be detected by the sensor.
• Make sure that pits, stairwells and trenches are monitored since they may fill with stagnant pockets of gas.
• If a pressure relief vent pipe is fitted to the system, it may be a requirement to mount a sensor to monitor this vent pipe. It should be positioned about 2 m above the pressure relief vent to allow gas clouds to form.
• With racks or chillers pre-fitted with refrigerant sensors, these should be mounted so as to monitor the compressors or if extract ducts are fitted the airflow in the duct may be monitored.

2.6 Refrigerated Spaces

In refrigerated spaces sensors should be located in the return airflow to the evaporators on a sidewall, below head high preferred, or on the ceiling, not directly in front of an evaporator. In large rooms with multiple evaporators, sensors should be mounted on the central line between 2 adjacent evaporators, as turbulence will result in airflows mixing.

2.7 Chillers

It is difficult to monitor reliably for leaks outdoors.
At a minimum you should monitor the compressors, as the general consensus is that most leaks occur in that area. Many chiller manufacturers regard this as meeting the requirement.
1. Install a standard sensor in enclosed machinery sections, in the compressors enclosures, or behind protective baffles such as acoustic panels.
2. Lastly you may wish to consider an airflow sensor in a start up fan section, especially where slow speed fans or variable speed drives are used, as they are likely to draw any leaked refrigerant through the sensor.

Purchasers of chillers would prefer the detection system to be already fitted. If not they can purchase fixed refrigerant monitors which are also used for retrofit.

2.8 Air Conditioning – Direct systems VRF/VRV

EN378 states that at least one detector shall be installed in each occupied space being considered and the location of detectors shall be chosen in relation to the refrigerant and they shall be located where the refrigerant from the leak will collect. In this case refrigerants are heavier than air and detectors should have their sensors mounted low .e.g. at less than bed height in the case of an hotel or other similar Category Class A spaces. Ceiling or other voids if not sealed are part of the occupied space.

⚠ In a hotel room monitoring in ceiling voids would not strictly comply with EN378

Do's	Don'ts

• mount the in-room sensor at less than the normal heights of the occupants e.g in a hotel room this is less than bed height - between 200-500mm off the floor.
• away from draughts and heat sources like radiators etc.
• avoid sources of steam
	• Do not mount sensors:
	  - under mirrors
	  - at vanity units
	  - in or near bathrooms

Tab. 2.a

For further detailed Installation tips covering most installations and equipment types, chillers, air cooled chillers etc see our web site www.carel.com.

2.9 Test/Function instructions

The Carel Gas Detector is calibrated in the factory and does not require to be calibrated on installation. After installation the units should be bump tested. Expose the sensors to test gas using a cigarette lighter (only for Semiconductor units) without igniting it and hold it over the vent holes on the upper right side of the Carel Gas Detector. The gas is heavier than air and should fall into the Carel Gas Detector. This will put the system into alarm. The red LED will light showing the system is in alarm. The delay will prevent the siren sounding or relay switching for the preset delay, if delay is set. In the case of CO_2, breathing on the sensor will generate a response as your breath is mostly CO_2.

With a bump test you can see the functions of the sensor - the red led will light, the relay and sounder will function, the output selected, say 0-10V- will show the gas level.

To test the siren and or relay function, check the delay is set at zero using the header as shown on the installation diagram and expose to gas as above. You can mute the siren by removing the jumper J3.

After the gas has cleared the red led, siren and relay will automatically reset.
Before testing the sensors on site the Carel Gas Detector must have been powered up and allowed to stabilize.

2.10 Trouble Shooting

All Carel Gas Detector units are checked and calibrated before shipment.
Symptom: Green /Red light on sensor is not lit.
Possible cause: power supply. Possible wiring fault. Check power supply, check your wiring.
Carel Gas Detector possibly damaged in transit. Check by installing another Carel Gas Detector to confirm fault.

If you experience spurious alarms in the absence of a leak, contact us for instructions and support.

During operation record any alarms. Establish the cause or likely cause if no leak has occurred. Report these occurrences to your supplier or Carel, and we will advise on corrective measures.

For gas: R22 - R134a - R404a - R407a -R407c - R407f - R410A - R290
h max 300 mm

For gas: C02
h max 1500 mm

For gas: NH3 - ETHYLENE
h max 300 mm
from ceiling

Note: to be installed close the cooler unit.
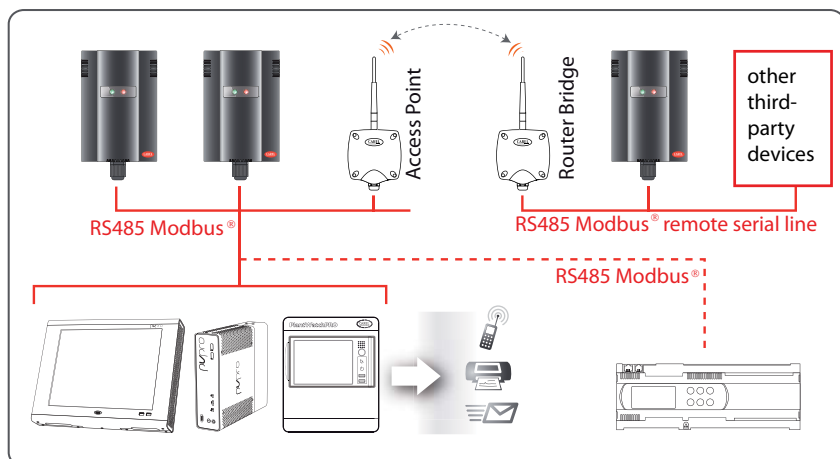
CAREL

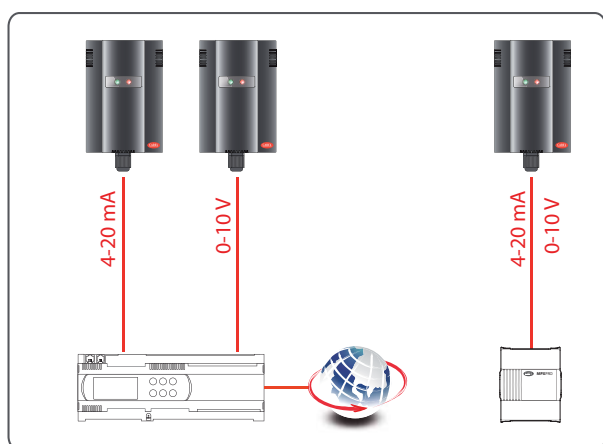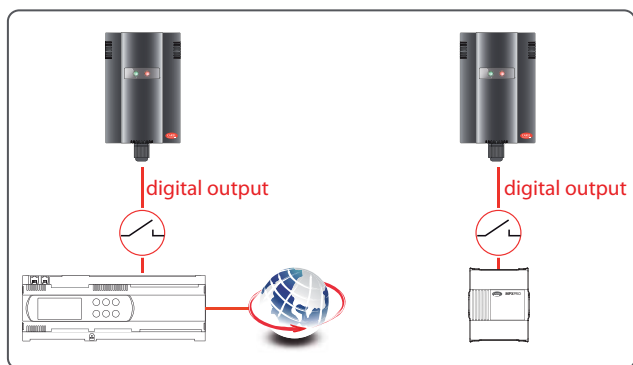## 2.11 Electrical connection diagram examples

Access Point

Router Bridge

other third-party devices

RS485 Modbus ®

RS485 Modbus ® remote serial line

RS485 Modbus ®

Fig. 2.e

4-20 mA

0-10 V

4-20 mA

0-10 V

Fig. 2.f

digital output

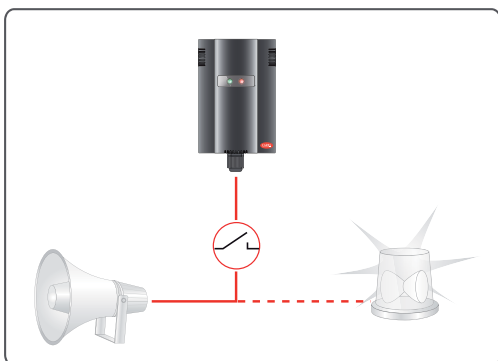digital output

Fig. 2.g

Note: check compatibility with the application on the controller.

Fig. 2.h

2.12 Electrical connections and configuration

Semiconductor sensor R22-R134a-R404a-R407a-R407c-R407f-R410a-R290 version
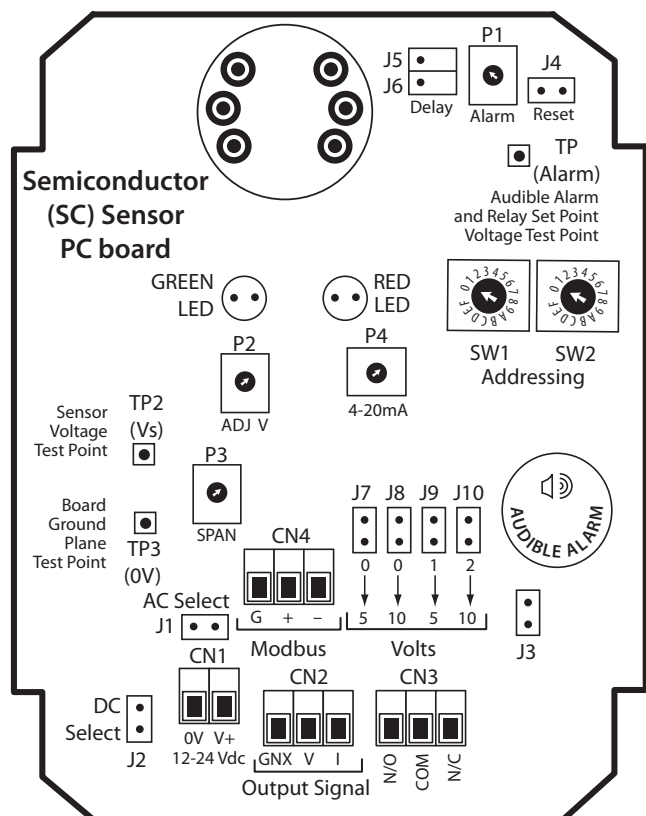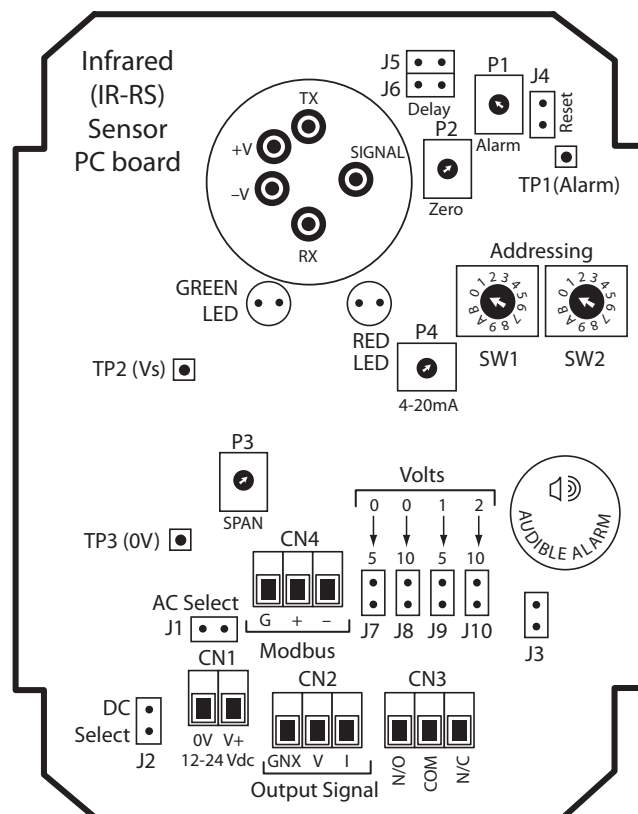

Fig. 2.i

Infrared sensor CO2 version

Fig. 2.j

Table of Jumper functions

J1 and J2 Power Supply Selection Jumper
J1 On J2 Off Unit is set for AC power supply (Factory default)
J1 Off J2 On Unit is set for DC power supply

J3 Audible Alarm Jumper
J3 On Sounder enabled – Audible alarm if setpoint reached (Factory Default)
J3 Off Sounder disabled – No alarms audible
If the unit is connected to a control system the sounder may also be disabled by using the software. However removing J3 will always disable the sounder.

J4 Reset Jumper
J4 On Halts unit operation
J4 Off (Factory default) Normal operation

J5 and J6 Delay Jumper for Audible Alarm and Relay
These jumpers determine the delay time between the unit detecting a gas concentration above the alarm set point and the activation of the Relay and Sounder.
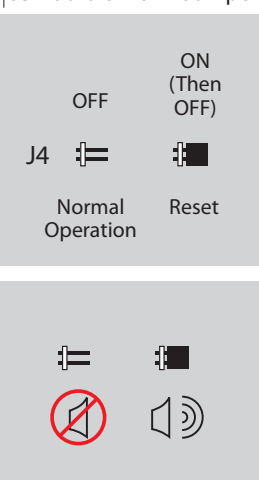J5 Off J6 Off No delay on sounder or alarm relay activation (Factory Default);
J5 On J6 Off 1 minute delay on sounder and alarm relay activation;

SW1 and SW2 Modbus Addressing

ADDR (DEC)	SW1 (LSB)	SW2 (MSB)	
D00	0	0	Reserved Address
D01	1	0	Valid Addresses
D02	0	1	
:	:	:	
D17	1	1	
:	:	:	
247	7	7	
248	8	F	Reserved Addresses
:	:	:	
255	F	F	

J4 Reset Jumper / J3 Audible Alarm Jumper

CN3 Relay Connector

J1 and J2 Power Supply Selection Jumper

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Infrared R134a-R404a-R407a-R410a-R290 version

Fig. 2.k

J5 Off J6 On 5 minute delay on sounder and alarm relay activation;
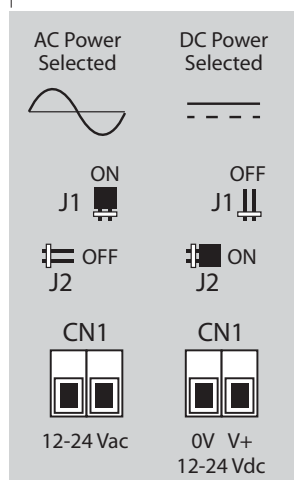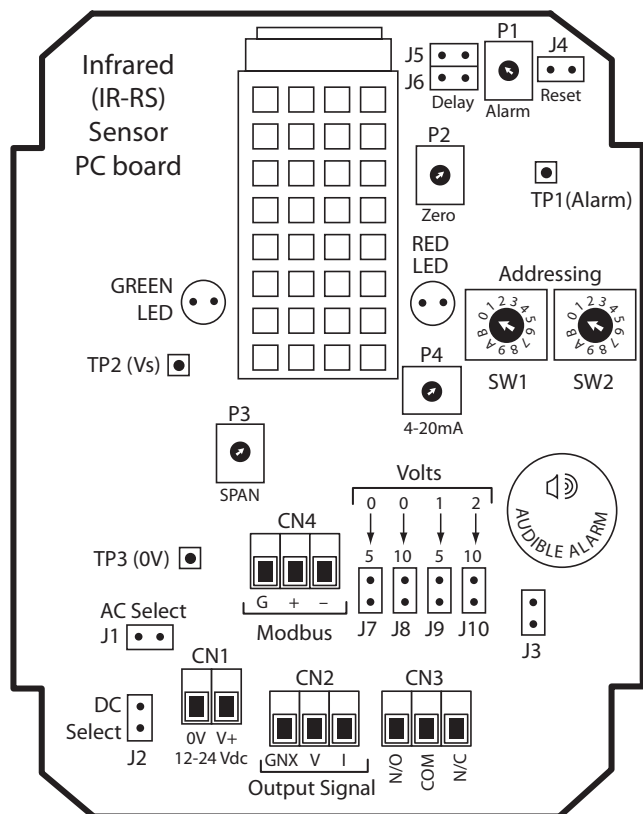J5 On J6 On 10 minute delay on sounder and alarm relay activation.

If the unit is connected to a control system the delays may be set by software up to 60 minutes. If there is a Jumper on J5 or J6, or both J5 and J6 have jumpers, the software value is cleared following a restart whereby the power to the detector is turned off and then turned on again. Following this restart the delay period is determined by the hardware so that the Jumpers J5 and J6 set the delay period. If there are no jumpers on both J5 and J6 the delay period set by the software is memorised and retained following a power cycle (power off / power on).

Enclosure Access
To open the standard sensor IP41 housing, turn the cable clamp 1/2 turn counter-clockwise to loosen the internal nut, depress the clip on top of the enclosure and open. Reverse to close. (For IP66, use the 4 hex bolts on the cover.)

J7-J10 Output Jumper or CN2 Output Signal Connector
This determines which voltage output range is selected. Only one voltage output may be selected at any time, so only one jumper may be on. The lowest value in the range corresponds with zero level of gas, the highest value in the range selected corresponds with the gas detector range (1000ppm for refrigerants, 10,000ppm for CO2).

J7 On 0-5V output enabled (Factory Default);
J8 On 0-10V output enabled;
J9 On 1-5V output enabled;
J10 On 2-10V output enabled.

Adjusting the alarm setpoint
This process is the same for all versions. See fig. 2.g 2.h for location of Alarm Potentiometer P1 and test points 0V(TP3) and Alarm Test Point (TP1). This process requires a volt meter, connecting the negative DC lead to TP3 and the positive DC Lead to TP1.
The first step is to determine the required setting for activation of alarm relay and sounder.

Factory Defaults are:
- 100ppm for Refrigerants R22/R134a/R407A/R407C/R410A semicond.;
- 200ppm for refrigerant NH3 / Ethylene - semiconductor;
- 800ppm for refrigerant R290 - semiconductor;
- 100ppm for Refrigerants R134a/R40A/R407C/R410A Infrared
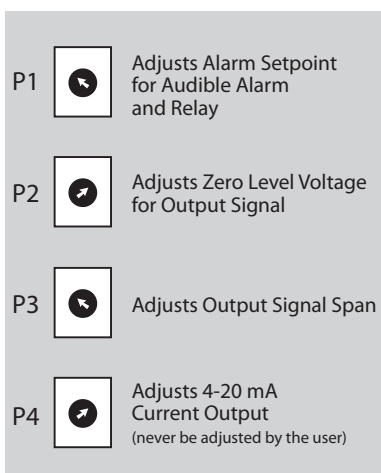- 1500ppm for Carbon Dioxide (CO2 infrared);

Then calculate the alarm relay voltage at the desired levels. The maximum voltage is 5V, so this corresponds with the detectors full scale range as shown on the rating label. Determine the alarm voltage by dividing the setpoint level by the full range scale and multiplying by the voltage (5V)

Example: for a full scale range of 0-1000ppm and relay required at 200ppm Alarm test Point Voltage = 200ppm/1000ppm x 5V = 1.0 Volts
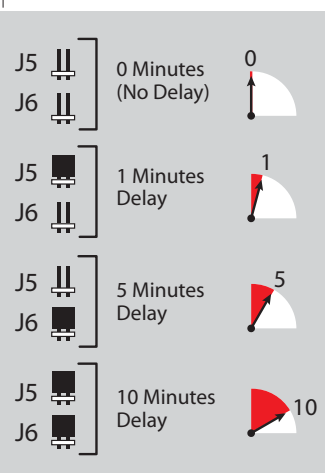
Alarm Pot P1 is used to adjust the set point at which the relay activates. Monitor the output between test points TP3 (negative) and TP1 (positive) on the voltmeter. Adjust Alarm Pot P1 until the desired alarm test point voltage is displayed by the voltmeter.

It is also possible to set the setpoint byserial comunication line

P1-P4 Adjustment Pots

P1		Adjusts Alarm Setpoint for Audible Alarm and Relay
P2		Adjusts Zero Level Voltage for Output Signal
P3		Adjusts Output Signal Span
P4		Adjusts 4-20 mA Current Output (never be adjusted by the user)

J5 and J6 Delay Jumper for Audible Alarm and Relay

CN4 Modbus Connector

J7-J10 Output Jumper or CN2 Output Signal Connector

G	Ground (Isolated from 0V)
+	Non-inverting Modbus Signal TxD+/RxD+
−	Non-inverting Modbus Signal TxD−/RxD−

"Gas Leakage Detector" +0300035EN - rel. 1.5 - 23.02.2015

Esempio schemi di collegamento

pRack / pCO3 (4 to 20 mA analogue input connection)

Fig. 2.l

ir33 universal (4 to 20 mA analogue input connection)

Fig. 2.m

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pCO5 / PVPRO / PWPRO (RS485 Modbus connection)

Fig. 2.n

Stand-alone operation

Fig. 2.o

3. CHECK AND CALIBRATION PROCEDURE

3.1 General warnings

The frequency and nature of testing or calibration may be determined by local regulation or standards.
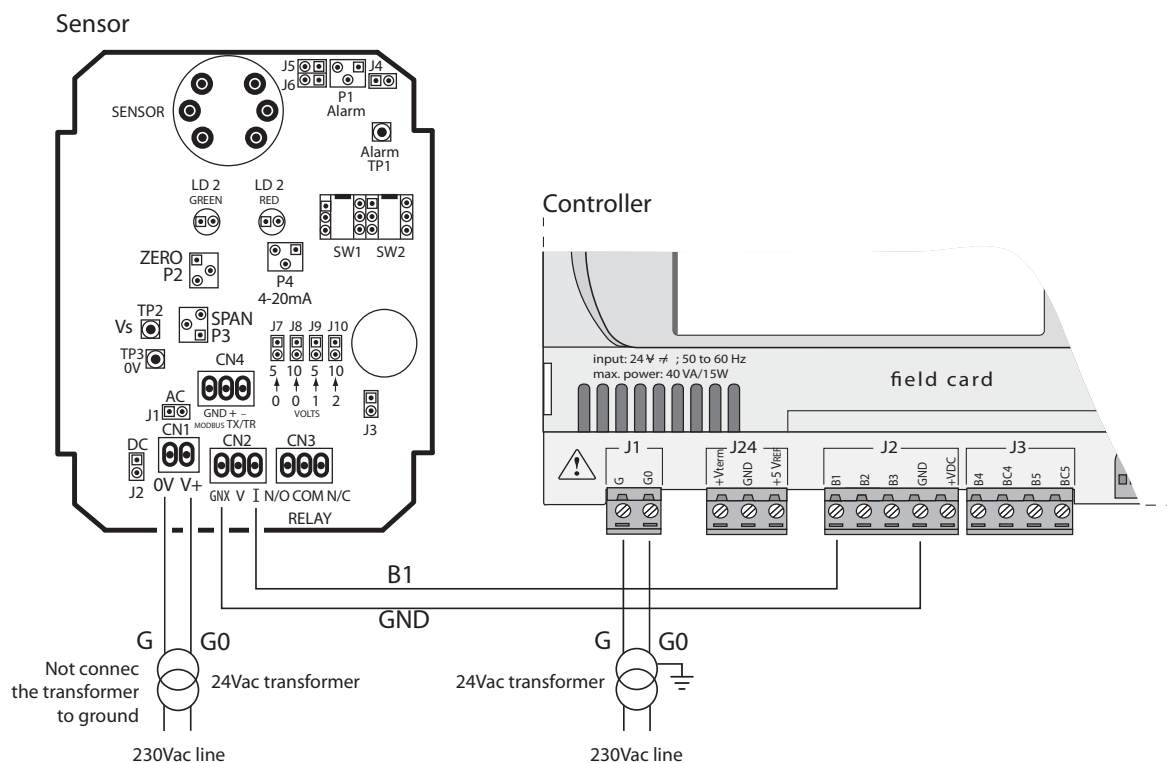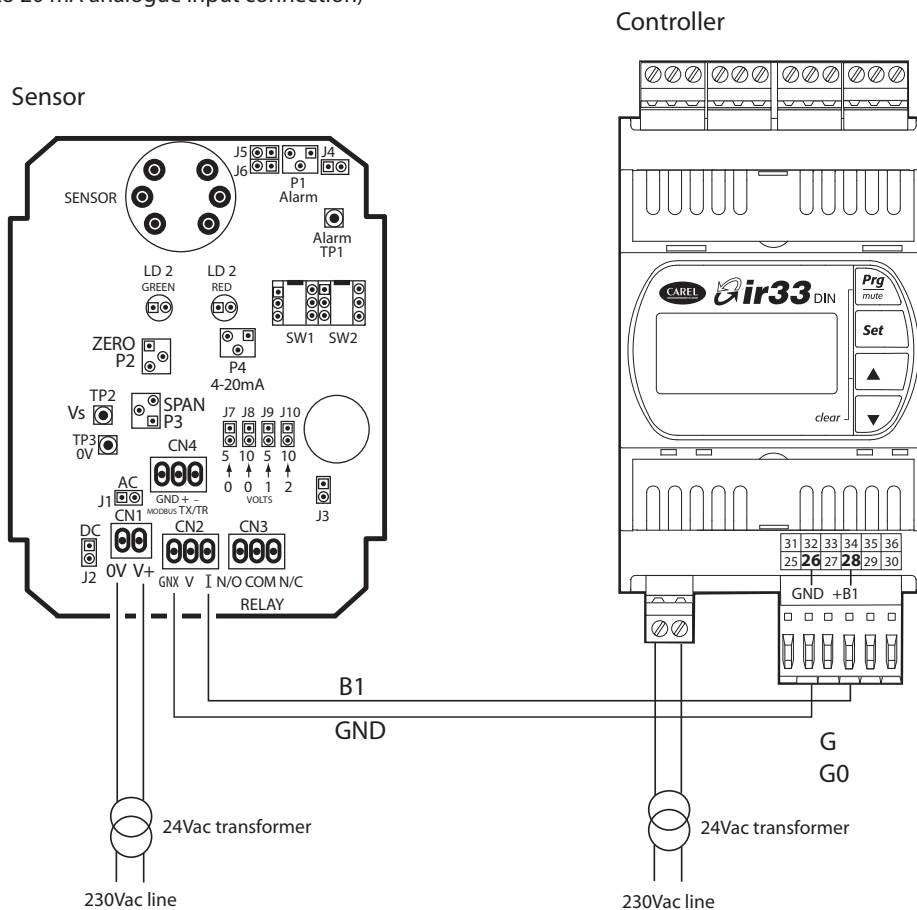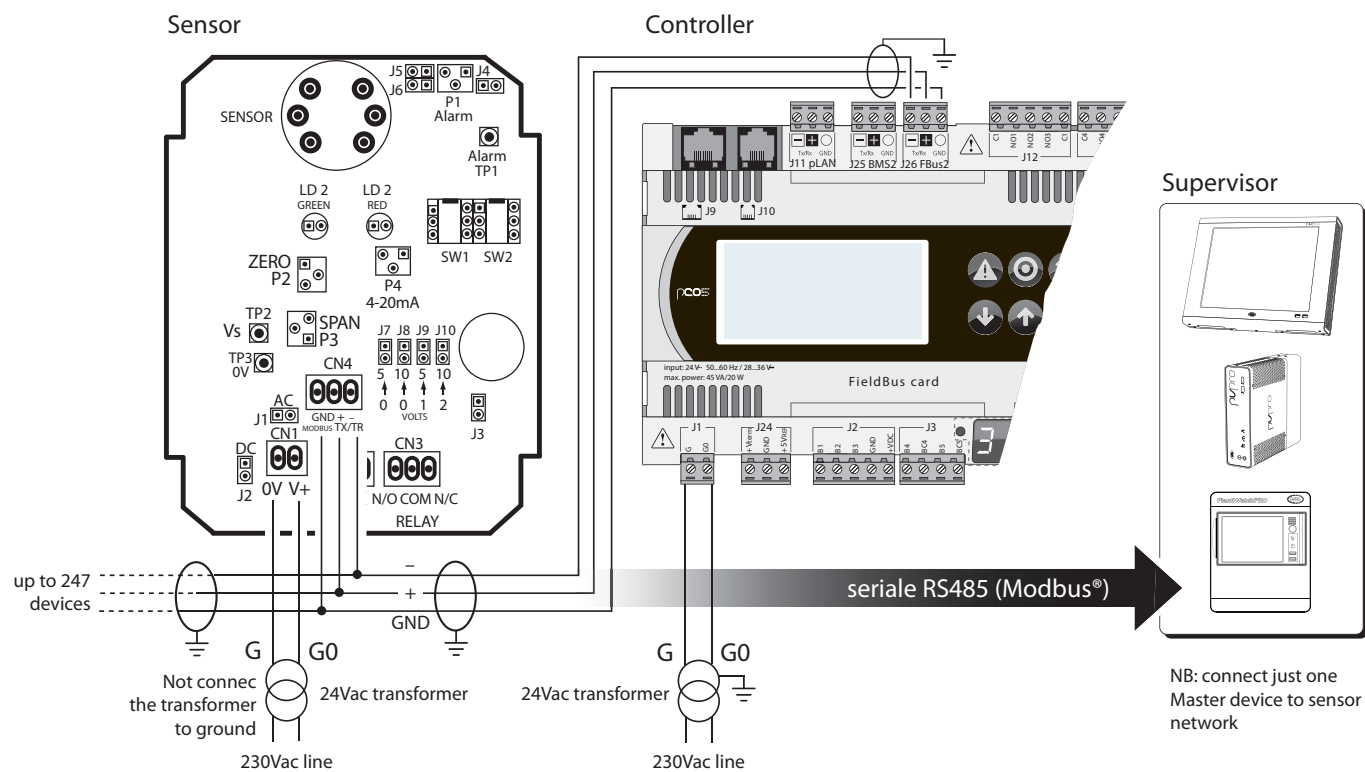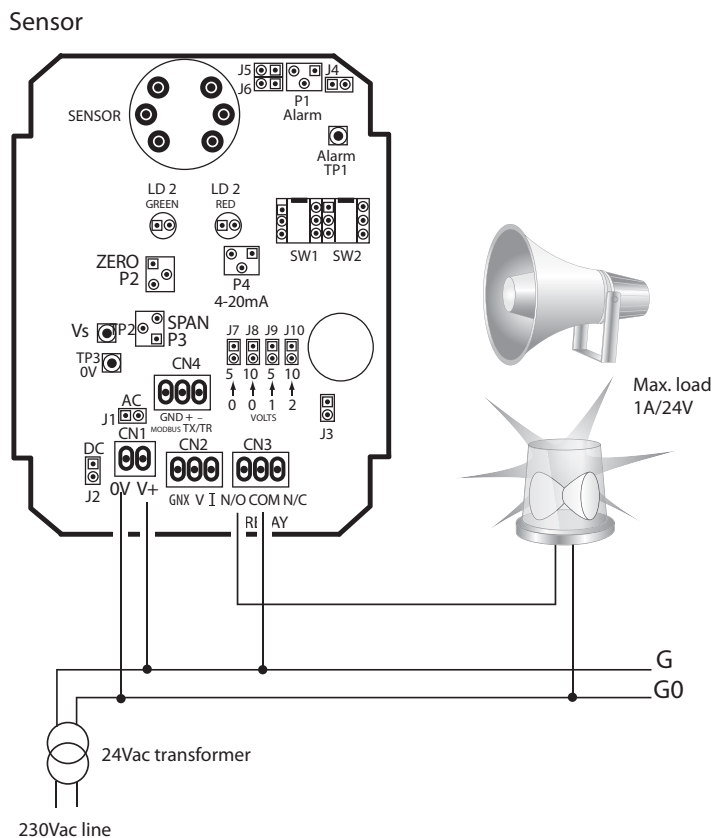
EN378 and the FGAS Regulation require an annual check in accordance with the manufacturer's recommendation.

Carel recommends annual checks by bump test and gas calibration on site at two yearly intervals or as required by test in the case of semiconductor SC sensors and infrared IR sensors with element sensor replacement every five years or as required. This should eliminate end of life concerns, and constantly renew the detection system.

If the Detector is exposed to a large leak it should be tested to ensure correct functionality by electrically resetting the zero setting and carrying out a bump test, see procedures below.

⚠️ **Important:** The testing and/or calibration of the unit must be carried out by a suitably qualified technician, and must be done:
• in accordance with this manual
• in compliance with locally applicable guidelines and regulations.
Suitably qualified operators of the unit should be aware of the regulations and standards set down by the industry/country for the testing or calibration of this unit. This manual is only intended as a guide and, insofar as permitted by law, the manufacturer accepts no responsibility for the calibration, testing, or operation of this unit.
The frequency and nature of testing or calibration may be determined by local regulation or standards. EN378 and the F-GAS Regulation require an annual check in accordance with the manufacturer's recommendation.

There are two concepts that need to be differentiated:
1. bump test;
2. calibration.

3.2 Bump Test

This consists of exposing the sensor to a gas and observing its response to the gas. The objective is to establish if the sensor is reacting to the gas and all the sensor outputs are working correctly.

There are two types of bump test.
• **Quantified:** where a known concentration of gas is used, or
• **Non-Quantified:** where a gas of unknown concentration is used.
•

⚠️ Before you carry out the test or calibration:
1. Advise occupants, plant operators, and supervisors.
2. Check if the detector is connected to external systems such as sprinkler systems, plant shut down, external sirens and beacons, ventilation, etc. and disconnect as instructed by the customer.
3. Deactivate alarm delays if selected at JP5, JP6 as per instructions in previous paragraph.
4. For Bump Test or Calibration the detector should be powered up overnight. If the unit has been installed and running for about 24 hrs, and you need to power it off for a short time to set the delay at 0 min, then the normalisation period is about 5 min (this is indicated by the green LED flashing) and then you can begin the testing or calibration. If detectors have been in long-term storage or the detectors have been turned off for a long time, normalisation would be much slower. However within 1-2 hours the detector should have dropped below the alarm setting and be operational. You can monitor normalisation progress exactly by monitoring the sensor output, on CON 2 between pins OV & V.

Bump Test (every year)

Ideally bump tests are conducted on site in a clean air atmosphere. Prior to carrying out a bump test, check and adjust the zero setting as described in the Calibration section.

Semiconductor: Cylinders of gas at known concentrations are available for quantified tests. This consists of exposing the sensor to the gas and checking that alarm lights and relays are activated. If this is not available, for a non-quantified test you can use a gas cigarette lighter. By cracking open the valve without igniting the gas, you release the gas onto the sensor and force it into alarm. Check that alarm light, sounder and relay are activated.

Infrared sensor for CO2: We offer cylinders of calibration gas at known concentrations. These are a quantified test. If these are not available, then you can breathe on the sensor. Human breath has enough CO_2 to trigger the alarm. This is a non-quantified test.

Bump Test Using Gas Cylinders

Remove the enclosure lid of the gas detector (not in an Ex area). Connect voltmeter to monitor sensor response, monitor 0-10V (Jumper J8 on) response on CON 2 between pins OV & V.
Expose the sensor to gas from the cylinder. You may add some blu-tack or similar material to allow the hood to adhere to the PCB. You can place the entire unit into a plastic bag or use a plastic hose/hood to direct gas to the sensor head. A response of above 80% is acceptable.
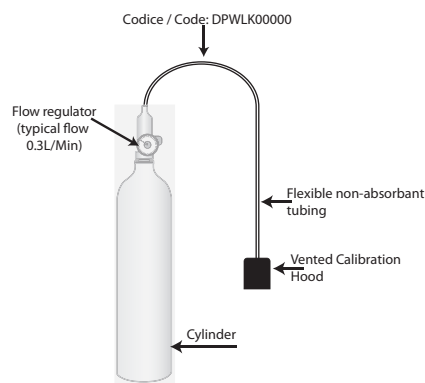
Calibration KIT

Codice / Code: DPWLK00000
Flow regulator (typical flow 0.3L/Min)
Flexible non-absorbant tubing
Vented Calibration Hood
Cylinder

Fig. 3.a

Note: gas cylinder and flow regulation are not supplied.

3.3 Calibration

This consists of exposing the sensor to a calibration gas, setting the "zero" or "Standby voltage", the span / range, and checking/adjusting all the outputs, to ensure that they are activated at the specified gas concentration.

The infrared versions (R134a, R404a, R407a, R410a) used a specific element sensor that does not need any calibration.

This is the adjustment of the gas detector's accuracy or recalibrating after sensor element exchange using calibration gas.

Carel offers a calibration kit hood with non-absorbant plastic tubing - to be used with a Calibration gas cylinder, a flow regulation valve (not supplied) with flexible non-absorbant tubing and vented calibration hood.

Tools required:
1. Gas can with the appropriate gas and concentration
2. A voltmeter- crocodile clips recommended
3. Estimate 30 min per sensor

The unit has two element sensor PCB versions: SC and IR.
Calibration and alarm relay set point is done on a 0-5V scale.

CAREL

Adjusting the alarm relay

This process is the same for all versions. See fig. 2.g and 2.h for location of pot P1 and test points 0V (TP3) and Alarm (TP1). The first step to setting the alarm relay at the desired levels:

- Pot P1 is used to adjust the set point at which the relay activates. Monitor the output between test points 0V (negative) and Alarm (positive). See example below.

  Example: For a range of 0-1000ppm, relay @ 100ppm

  Relay $= 100$ ppm x $\dfrac{5}{1000}$ so that Alarm relay = 0.5 Volts

  while the 0-5V output sensor signal corresponds to 0-1000 ppm range.

Element sensor PCB – adjusting the detection range:
1. **Semiconductor Sensor (SC) for refrigerants**

   There are two adjustments required: the zero and the span. They are monitored at 0V and VS on a 0-5V scale. If the target range is 0-1000ppm, and the gas used is 1000 ppm then 5V=1000ppm.

   Pot P2 is used to adjust the zero of the range (span). Monitor the output between 0V (negative) and VS (positive) and adjust the Pot to 0 V or slightly positive (0.01 V is acceptable).

   Pot P3 is used to calibrate the range (span) of the sensor. Monitor the output between 0V (negative) and VS (positive). Expose the sensor to calibration gas and allow to stabilise and adjust pot P3 to 5V.

2. **Infrared (CO_2)**

   Pot P2 is used to adjust the zero of the range (span). Monitor the output between 0V (negative) and VS (positive) and expose the sensor to Nitrogen or zero air, and once stable, adjust the Pot to 0 V or slightly positive (0.01 V is acceptable).

   Pot P3 is used to calibrate the range (span) of the sensor. Monitor the output between 0V (negative) and VS (positive). Expose the sensor to calibration gas and allow to stabilise and adjust pot P3 to 5V.

   NOTE: Sensors outputs are linear, thus as long as you have a gas canister of known concentration you can calibrate to any desired range.

   Example: For a range of 0-1000ppm, and a canister of the target gas at 800ppm
   The 0-5V signal corresponds to 0-1000, thus if using the above canister:
   Voltage= 800 ppm x $\dfrac{5}{1000}$ $= 4V$ and so the output voltage signal should be adjusted to 4V.

Fig. 3.b

Fig. 3.c

3.4 Additional recommendations

False alarms: If false alarms are being triggered by background gases, paint fumes, etc, extreme humidity or temperature conditions, you will find that the zero has moved to a + value, you can adjust the zero setting back to zero to compensate. You may also increase the response time delay to help eliminate false alarms.

Normalisation Period: below we show typical time to normalize for various sensor types. The units are powered up and the output voltage monitored on the 0-10V-output. The approximate time to drop to near 0V is shown.

Sensor Type	Stabilised ~0V
Semi-Conductor	1-3 Minute
Infrared	2 Minutes

Semiconductors output over the + max scale i.e. > 5V. Both move towards zero as they stabilise. Infra red output will be approximately zero volt for 60 to 120 seconds and after stabalisation, will read room content of CO2.

If sensors have been in long-term storage or the detectors have been turned off for a long period, normalisation would be much slower. However within 1-2 hours sensors should have dropped below the alarm level and be operational. You can monitor progress exactly by monitoring the 0-10V output, when the output settles around zero the sensor is normalised. In exceptional circumstances the process can take up to 24 hours or more to get to 0V, again monitor the 0-10V output and you can see what is happening.
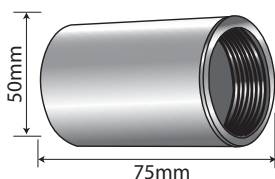
4. ACCESSORIES

4.1 Element sensors

6133015AXX "HCFC, HFC and ETHYLENE refrigerant gas sensor for semiconductor version

6133017AXX HCFC, HFC and ETHYLENE refrigerant gas sensor for semiconductor version cable 5m
6133018AXX CO_2 refrigerant gas sensor for infrared version cable 5 m

6133019AXX "NH3 - R290 refrigerant gas sensor for semiconductor version"

50mm
75mm

DPWLKIT100 **Water spray protection for IP66 version**
On the IP66 version, the sensor can be protected by screwing a cap onto the sensor.

6133016AXX CO_2 refrigerant gas sensor - for infrared version

PWLKIT010 Calibration adapter (hose and 4 hoods)

4.2 Calibration Cup Datasheet

Calibration Cup Assy - IP66
Cup Inner Diameter: 42.8 mm
Tubing Inner Diameter: 5 mm
Usage: all IP66 and IP66 Remote Heads

Calibration Cup Assy, HCFC SC Type
Cup Inner Diameter: 23.4mm
Tubing Inner Diameter: 5mm
Usage: IP41 units with TGS832F sensor

Calibration Cup Assy, Combustible SC Type
Cup Inner Diameter: 16.6mm
Tubing Inner Diameter: 5mm
Usage: IP41 units with TGS813 sensor

Calibration Cup Assy, IR-RS
Cup Inner Diameter: 42.8mm
Tubing Inner Diameter: 5mm
Note: The cup has four equal cuts to allow it to fit over the IR-RS sensor as shown below.
Usage: IP41 units with IR-RS sensor

CAREL code: DPWLA27000
DPWLB27000 - DPWLC27000
DPWLD27000 - DPWLE27000
DPWL417000 - DPWL427000

CAREL code: DPWLA07000
DPWLB07000 - DPWLC07000
DPWLD07000 - DPWLE07000
DPWLQ07000 - DPWLR07000

CAREL code: DPWLG07000

CAREL code: DPWLJ07000
DPWLK07000 - DPWLL07000
DPWLM07000 - DPWLN07000

DPWLKIT200   Red electronic audible and visual alarm, 12/24 Vac/dc IP65

The Carel audible and visual alarm device is useful for signalling local or remote alarms that need continuous monitoring. The device, powered at low voltage, features low power consumption and can be confi gured with 16 different signals (8 sounds with light on steady, and 8 sounds with flashing light). The signal can be confi gured during installation using two switches (SWA and SWB). Operation should be tested at least once a year.

For more information see technical leaflet +050001415

5.   MODBUS RTU PROTOCOL

5.1   Modbus RTU (Remote Terminal Unit) Protocol

Connector CN4 (labelled +, – and GNX) is an RS-485 port for communicating with the CAREL gas detectors in Modbus-RTU protocol. "+" is the noninverting data signal, "–" is the inverted data signal and GND is the board ground plane.

5.2   Address

There are 256 selections, and the addresses are numbered 0 to 255 inclusive. Addresses are selected by rotating the hexadecimal dial switches SW1 and SW2. Values 1 to 247 are valid / usable addresses providing a unique identity for each gas detector. Addresses 248 to 255 and address 0 are reserved for implementing specific features. Modbus data with a zero in the address field is received by all detectors (irrespective of the address selected by the dial switches) to enable the master device to broadcast simultaneously to all the detectors. Switch SW1 selects addresses 0 to 15 and switch SW2 multiplies the address by a factor of 16.

Address	SW1	SW2	Selection
0	0	0	reserved
1	1	0	Address 1
2	2	0	Address 2
:	:	:	:
9	9	0	Address 9
10	A	0	Address 10
11	B	0	Address 11
12	C	0	Address 12
13	D	0	Address 13
14	E	0	Address 14
15	F	0	Address 15
16	0	1	Address 16
17	1	1	Address 17
:	:	:	:
246	6	F	Address 246
247	7	F	Address 247
248	8	F	reserved
249	9	F	reserved
250	A	F	reserved
:	:	:	:
254	E	F	9600 Baud
255	F	F	19200 Baud

Tab. 5.a

SW1
E = 14

SW2
F = 15
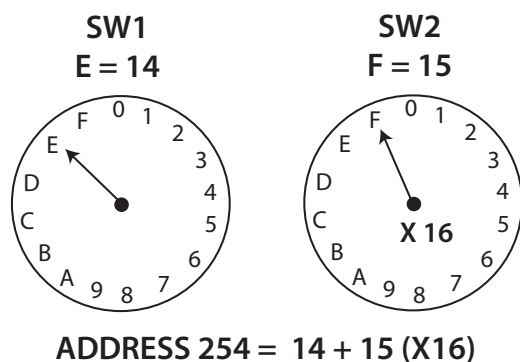
ADDRESS 254 = 14 + 15 (X16)

Fig. 5.a

As an example, address 254 is reserved for setting the Baud rate to 9,600 bits per second. To choose a baud rate, select the address and reset the gas detector by shorting jumper J4 or by cycling the power ON and OFF. The desired Modbus address (1-247) can subsequently be selected. During a setting Baud rate leds will blinking:
• green 9600;
• red 19200.

Address	SW1	SW2	
254	E	F	Selects 9,600 Baud (bits per second).
255	F	F	Selects 19,200 Baud (bits per second).

Tab. 5.b

Specifications

Baud Rate	9600	19200	bits per second (selectable using the address rotary switches)
Start	1	1	bit
Data	8	8	bits
Parity	0	0	bit
Stop	2	2	bits
Retry	500	500	milliseconds (minimum time between retries)
End of message	3.5	3.5	characters (a silent of 3.5 characters indicates the end of a message, a new message can begin after this interval)

Tab. 5.c

Function Codes

Function codes specify the action to be performed on the data in the registers of the gas detector.

Function Code		Action	Registers	
01	Read Output	Digital Status flags	400	read / writable
02	Read Input	Digital Status flags.	300	read only
03	Read Output	Analogue Holding Registers	200	read / writable
04	Read Input	Analogue Input Registers	100	read only
05	Write to Output	Digital Status flags	400	writable
06	Write to Output	Analogue Holding Registers	200	writable

Tab. 5.d

5.3   Register Map

The Register Map specifies the details of storage locations (registers and flags) within the detectors.

Analogue Input Registers (Input Registers are read only)		Function Code 04	
Register	Description	Range	Unit
100	Concentration gas level (% of full scale)	0 : 100	%
101	Concentration gas level in ppm.	0 : 65,535	ppm
103	Full scale sensor level in ppm	0 : 65,535	ppm
104	Alarm set-point (% of Full Scale)	0 : 100	%
105	Sensor timer	0 : 65,535	hours
106	Detector address	1 : 247	
107	Software version	10	
108	Detector Code	270	

from revision 2.025			
109	Order Number	300	

Tab. 5.e

Concentration Registers 100,101

The real time gas concentration is available in different formats, register 100 keeps track of the percentage concentration for example a value of 33 represents 33% of the maximum detectable gas concentration. Register 101 maintains the detected concentration in parts per million.

Full Scale Sensor Level (in ppm) Register 103

The full scale sensor level is the maximum detectable gas concentration for the detector. This maximum rating is stored in register 103, so for the example register 103 holds the value 1000 to represent 1000 parts per million (ppm).
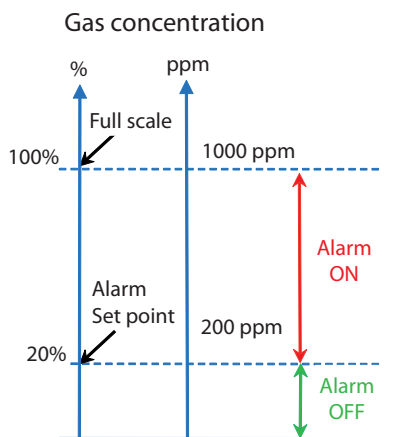
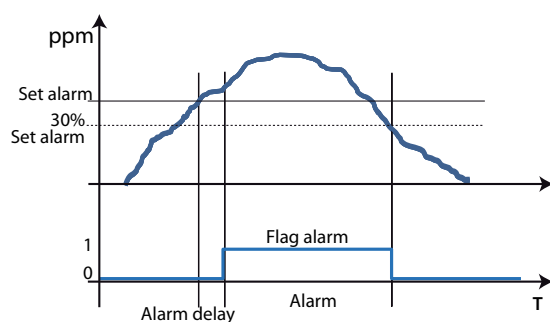### Gas concentration

Fig. 5.b

Fig. 5.c

Alarm Set Point (% of Full Scale) Register 104

The Alarm Set Point is the threshold at which the gas concentration has reached a level to warrant the activation of the Alarm flag by setting a 1 in register 300, the red LED alarm visual indicator and the relay and sounder. If a delay period is set in registers 201, the relay and the sounder will not be immediately activated but the red LED be illuminated and the Alarm Flag will be set. The duration of the delay will be measured from this instance that the gas concentration exceeds the alarm set point. The Alarm Set Point can be controlled using the detector hardware by adjusting the potentiometer P1 and monitoring the voltage on test point TP1 with respect to test point TP3 (0 Volts). Alternatively a software value can be written into register 200 and the hardware potentiometer setting is disregarded until the software value is reset back to zero, so although register 104 can only be read, its value can be modified by writing to register 200.

The Alarm Set Point is measured as a percentage of the full scale so for example 1.0 Volts on TP1 with respect to TP3 corresponds to a 20% Alarm Set Point given that the maximum voltage is 5.0 Volts. The Alarm Set Point register 104 will contain 20 to represent 20% and this corresponds to a 200 ppm alarm threshold.

Note - from revision 2.025
- Relay operation is dependent on the value of the Failsafe Relay Enabled flag (register 402).
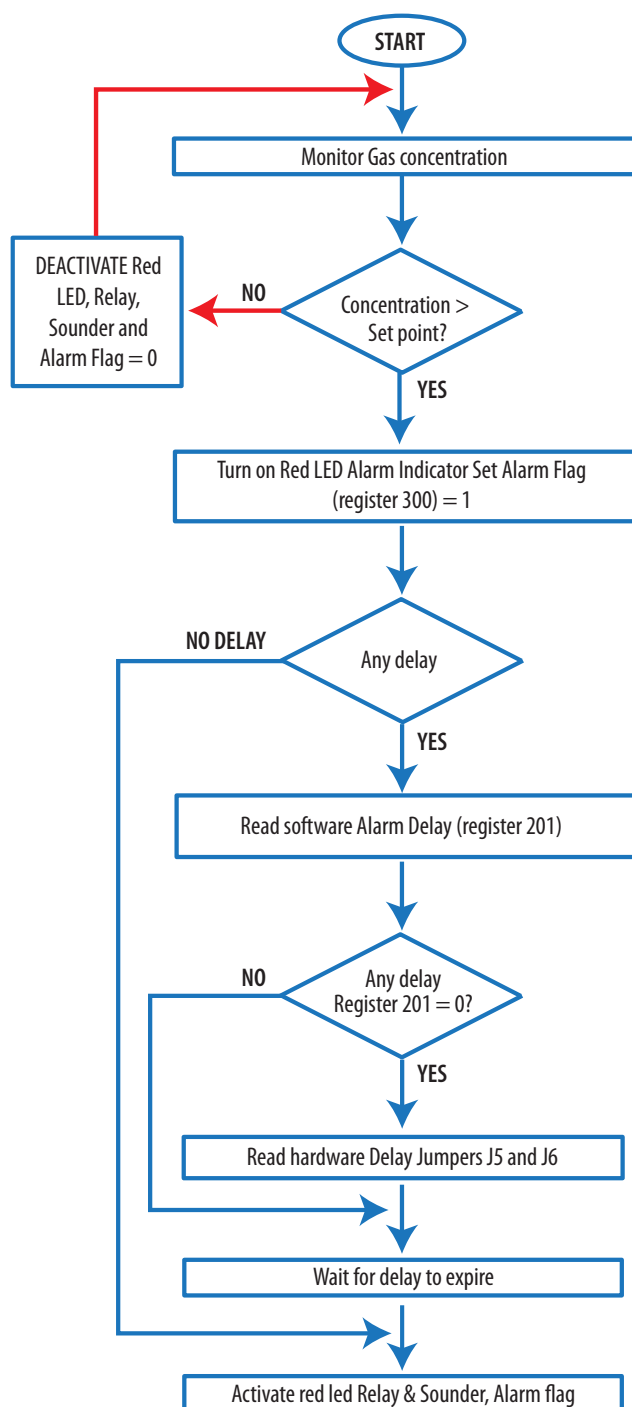

Fig. 5.d

Sensor Timer Register 105

The sensor timer register keeps a count of the number of hours the sensor is on. The register is incremented every hour and after one year the register will exceed 8760 hours and the Test Flag will be set to 1 to indicate that the detector requires testing. The Test Flag Register is located at address 401 and can be cleared to indicate that the sensor and detector have passed the annual test.

Detector Address 106

The detector address is the value of address set by the hexadecimal switches.

Software Version 107

The software version is the revision of firmware operating on the processor of the detector.

Detector Code 108

The detector code is a proprietary machine number for identifying the classification of detector.

Order Number 109

The order number is a proprietary number associated to the detector to distinguish the concentration range and gas type.
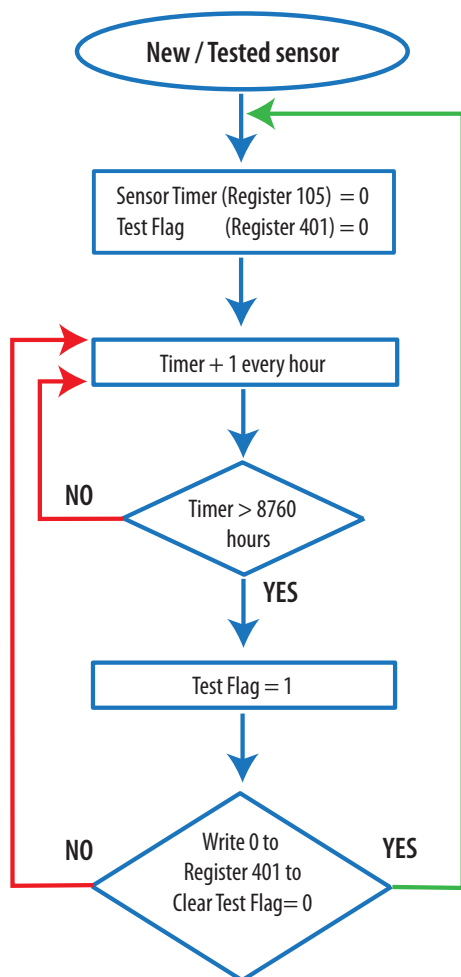
Analogue Output Holding Registers (Output / Holding Registers are readable & writable)			read Function Code 03 write Function Code 06
Register	Description	Range	Details
200	Alarm Set Point (ppm)	0 : 65,535	Alarm set-point / threshold in parts per million
201	Alarm Delay	0 : 59	The Alarm Delay is the time in minutes after the gas concentration exceeds the alarm level and the Alarm Flag Register 300 is set to 1.
202	Sounder Delay	0 : 59	The Sounder Delay is the time in minutes the sounder is deactivated for during the alarm phase when the gas concentration exceeds the alarm set point.

from revision 2.025

203	Warning Threshold	0 : 65,535	Warning Threshold alarm level in parts per million

Tab. 5.f

Alarm Set Point (in ppm) Register 200

The Alarm Set Point register 200 stores the software setting for the alarm set point in parts per million (ppm). Writing the value zero into this register will enable the hardware potentiometer P1 to determine the Alarm Set Point. If a value greater than zero and less then the full scale sensor limit in ppm is written into register 200 then the hardware potentiometer setting is ignored and effectively overrides the hardware alarm set point.

Note - from revision 2.025
Relay operation is dependent on the value of the Failsafe Relay Enabled flag (register 402).
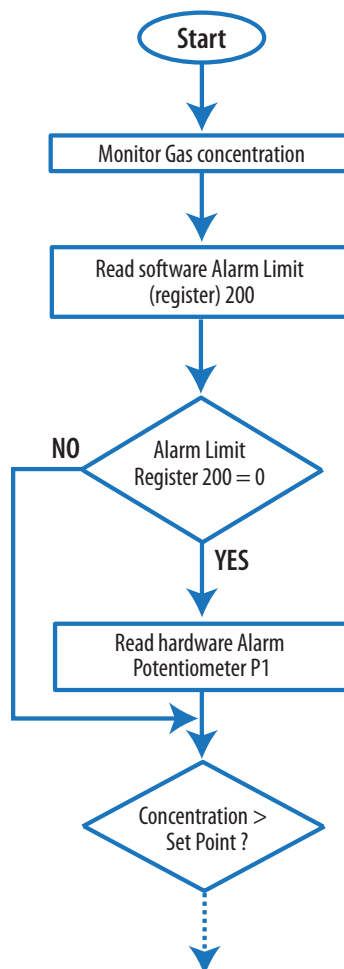

Fig. 5.e

Fig. 5.f

Alarm Delay Register 201

The Alarm Delay Register 201 stores the software alarm delay period up to 59 minutes and the jumpers J5 and J6 set the hardware alarm delay period. The alarm delay is the duration between the unit detecting a gas concentration above the alarm set point and the activation of the red LED alarm indicator, the relay, the sounder and setting the Alarm Flag register 300 with the value 1. If there is a jumper on J5 or J6 or both J5 and J6 have jumpers on and connecting the pins, the software value is cleared following a restart whereby the power to the detector is turned off and then turned on again. Following this restart the delay period is determined by the hardware so that the Jumpers J5 and J6 set the delay period. If there are no jumpers on both J5 and J6 the delay period written into the alarm delay register 201 is used as the delay and is memorised and reused after a power cycle when the power is turned OFF and back ON.

Note - from revision 2.025
Relay operation is dependent on the value of the Failsafe Relay Enabled flag (register 402).
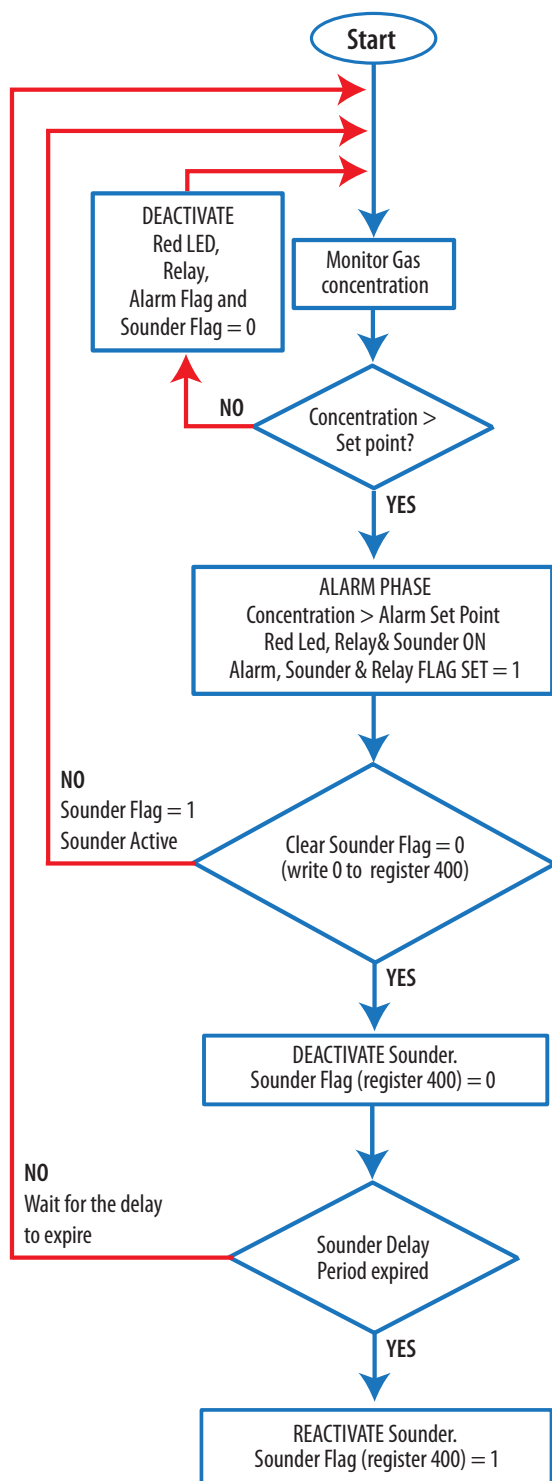
⚠️ **Important:** If variables HR200 and HR201 are changed, make sure the new value assigned is within the operating range.
If these variables are set with values outside of the range, the values will be set to 0, and the device will read the hardware setting, if available (trimmer P1 and jumpers J5 and J6).
When switching off and on again, the variables will automatically return to the last valid value set via Modbus.
When used together with Carel supervisors (PWPRO and PVPRO), this situation does not occur.

Sounder Delay Register 202

The Sounder Delay is the time in minutes the sounder is deactivated for during the alarm phase when the gas concentration exceeds the alarm set point. The alarm condition will activate the red LED alarm indicator, the relay, the sounder and the associated flags will be set to the value 1. The alarm flag in register 300, the relay flag in register 301 and the sounder flag in register 400 are set with the value 1 to indicate the active alarm state. Clearing the Sounder Flag, by writing the value zero into register 400 will deactivate the sounder for the period defined by the sounder delay register 202. The sounder delay is in minutes and the maximum value is 59 so for example if the value in register 202 is 25, then the sounder will be disabled for 25 minutes during an alarm condition. After this 25 minute mute period the sounder will be reactivated if the detector is still detecting gas concentrations in excess of the alarm set point, otherwise the sounder will not be reactivated if the gas concentration has gone below the alarm set point.

Note - from revision 2.025
Relay operation is dependent on the value of the Failsafe Relay Enabled flag (register 402).

Warning Threshold (in ppm) Register 203

The Warning Threshold register 203 stores the software setting for the Warning Alarm set point in parts per million (ppm).
If the operation of the Warning Threshold is enabled (register 403 is set) and the gas concentration exceeds this threshold then the Warning Threshold Exceeded (register 307) flag will be set to 1.
If the above conditions have been met and the Warning Activates Relay flag (register 404) is set then the relay will also be activated.
Note: Relay operation is dependent on the value of the Failsafe Relay Enabled flag (register 402). See below for further details.
The Warning Threshold must be less than or equal to Normal Alarm Threshold.
If the Warning Threshold is attempted to be programmed to a value greater than the Normal Alarm Threshold then it will remain at the previous setting.
If the Warning Threshold has been programmed and then the Normal Alarm Threshold is changed to a level less than the Warning Threshold then the Warning Threshold will be set equal to the Normal Alarm Threshold and this value stored in memory. If the Normal Alarm Threshold is then increased again the Warning Threshold will not be changed and will remain at the lower level. This is required as the alarm potentiometer could be adjusted after programming the Warning Threshold or the Normal Alarm Level reprogrammed by Modbus.
If Register 403 "Warning Threshold Enabled" is cleared (set to zero) then the "Warning Threshold" will also be set to zero and this value stored.
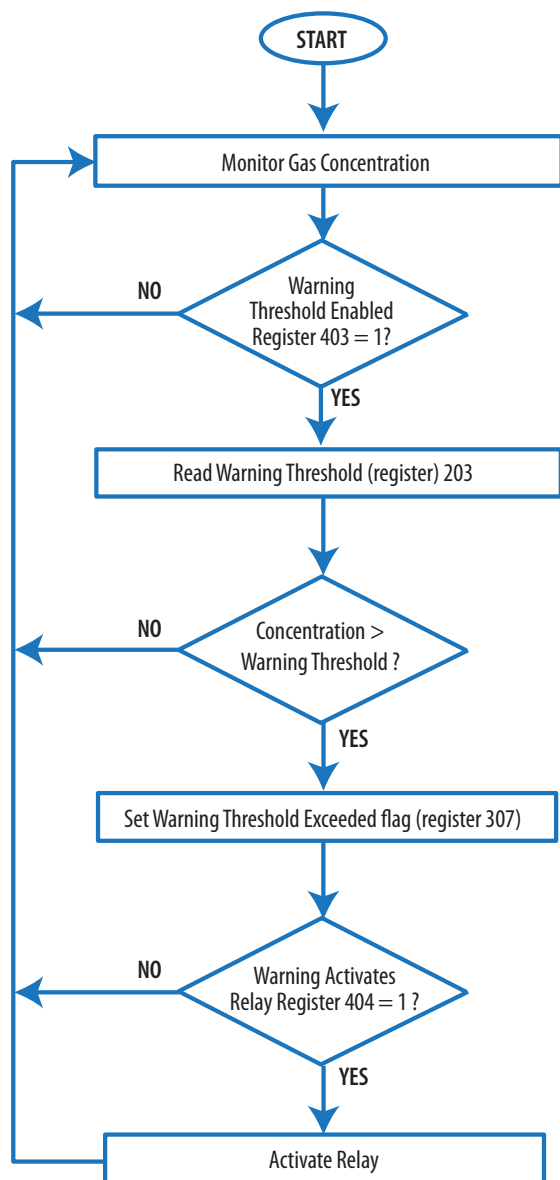

Fig. 5.g

START

Monitor Gas Concentration

Warning Threshold Enabled Register 403 = 1? — NO

YES

Read Warning Threshold (register) 203

Concentration > Warning Threshold ? — NO

YES

Set Warning Threshold Exceeded flag (register 307)

Warning Activates Relay Register 404 = 1 ? — NO

YES

Activate Relay

Fig. 5.h

Output Status Flags (Output Status Flags are readable & writable)			read Function Code 01 write Function Code 05
Register	**Description**	**Range**	**Details**
400	Sounder Flag	0 : 1	1: Sounder is on 0: Sounder is off
401	Test Flag	0 : 1	1: Sensor on / operating for more than 1 year and requires testing. 0: Sensor does not require testing yet.
from revision 2.025			
402	failsafe relay Enable	0 : 1	1: Failsafe relay operation (see table for relay logic) 0: Standard relay operation (default)
403	Warning Enabled	0 : 1	1: Warning threshold operation is enabled 0: Warning threshold operation is disabled (default)
404	Warning Activates Relay	0 : 1	1: gas concentrations in excess of the Warning Threshold (Register 203) will activate the relay 0: gas concentrations in excess of the Alarm Threshold (Register 200) will activate the relay (default)

Tab. 5.h

Failsafe Relay Enabled Register 402 and Warning Activates Relay Register 404

The operation of the relay is dependent on the following:

- Failsafe Relay Enabled Register 402
- Warning Activates Relay Register 404
- Gas level Register 100 or Register 103
- Warning alarm threshold Register 203
- Alarm set point Register 104 or Register 200

If Failsafe Relay Operation is disabled: Register 402 = 0 (default)
- On power-up
  - De-energise relay: NO Output is open
- On sensor fault
  - Energise relay: NO Output is closed
- If Warning Activates Relay Register 404 = 1 and the gas level exceeds the Warning Threshold Register 203
  - Energise relay: NO Output is closed
- If Warning Activates Relay Register 404 = 0 and the gas level exceeds the Warning Threshold Register 203
  - De-energise relay: NO Output is open
- If the gas level exceeds the Normal Alarm Threshold Register 200
  - Energise relay: NO Output is closed

If Failsafe Relay Operation is enabled: Register 402 = 1 (Failsafe)
- On power-up
  - Energise relay: NO Output is closed
- On sensor fault
  - De-energise relay: NO Output is open
- If Warning Activates Relay Register 404 = 1 and the gas level exceeds the Warning Threshold Register 203
  - De-energise relay: NO Output is open
- If Warning Activates Relay Register 404 = 0 and the gas level exceeds the Warning Threshold Register 203
  - Energise relay: NO Output is closed
- If the gas level exceeds the Normal Alarm Threshold Register 200
  - De-energise relay: NO Output is open

Input Status Flags (Input Status Flags are read only)			Function Code 02
Register	**Description**	**Range**	**Details**
300	Alarm Flag	0 : 1	1: Gas concentration is greater or equal to alarm set-point 0: Gas concentration is less than the alarm set-point
301	Relay	0 : 1	1: Relay is energised. 0: Relay is de-energised
302	Sensor Fault	0 : 1	1: Sensor absence or open circuit sensor fault is detected. 0: Sensor present / in circuit and no open circuit fault detected
303	Red LED	0 : 1	1: Red LED is on. Alarm Indication or Fault Indication if green LED is off. 0: Red LED is off. No alarm or fault condition exists.
304	Green LED	0 : 1	1: Green LED is on. Power indicator, detector powered on. 0: Green LED is off. No power or fault condition if the red LED is on
from revision 2.025			
305	Reserved		reserved for future use
306	Reserved		reserved for future use
307	Warning Threshold Exceeded	0 : 1	This is only operations if registred 403 is set to 1 1= gas concentration is greater than or equal to the Warning Threshold 0= gas concentration is less than the Warning Threshold

Tab. 5.g

CAREL

5.4 Variable list:

Analogue Input Registers (read only)
Function Code 04

Register	Description	Range	Unit
100	Concentration gas level (% of full scale)	0 : 100	%
101	Concentration gas level in ppm.	0 : 65,535	ppm
103	Full scale sensor level in ppm	0 : 65,535	ppm
104	Alarm set-point (% of Full Scale)	0 : 100	%
105	Sensor timer	0 : 65,535	hours
106	Detector address	1 : 247	
107	Software version.	10	
108	Detector Code	270	
109	Order Number	300	

Tab. 5.i

Analogue Output Holding Registers (readable & writable)
read Function Code 03
write Function Code 06

Register	Description	Range	Details
200	Alarm Set Point (ppm)	0 : 65,535	Alarm set-point / threshold in parts per million
201	Alarm Delay	0 : 59	The Alarm Delay is the time in minutes after the gas concentration exceeds the alarm level and the Alarm Flag Register 300 is set to 1.
202	Sounder Delay	0 : 59	The Sounder Delay is the time in minutes the sounder is deactivated for during the alarm phase when the gas concentration exceeds the alarm set point.
203	Warning Threshold (ppm)	0 : 65,535	Warning threshold alarm level in parts per million

Tab. 5.j

Input Status Flags (read only)
Function Code 02

Register	Description	Range	Details
300	Alarm Flag	0 : 1	1: Gas concentration is greater or equal to alarm set-point 0: Gas concentration is less than the alarm set-point
301	Relay	0 : 1	1: Relay is energised. 0: Relay is de-energised
302	Sensor Fault	0 : 1	1: Sensor absence or open circuit sensor fault is detected. 0: Sensor present / in circuit and no open circuit fault detected
303	Red LED	0 : 1	1: Red LED is on. Alarm Indication or Fault Indication if green LED is off. 0: Red LED is off. No alarm or fault condition exists.
304	Green LED	0 : 1	1: Green LED is on. Power indicator, detector powered on. 0: Green LED is off. No power or fault condition if the red LED is on
305	Reserved		Reserved for future use
306	Reserved		Reserved for future use
307	Warning Threshold Exceeded	0 : 1	This is only operational if Register 403 is set to 1

Tab. 5.k

Output Status Flags (readable & writable)
read Function Code 01　　　write Function Code 05

Register	Description	Range	Details
400	Sounder Flag	0 : 1	1: Sounder is on 0: Sounder is off
401	Test Flag	0 : 1	1: Sensor on / operating for more than 1 year and requires testing. 0: Sensor does not require testing yet.
402	Failsafe Relay Enabled	0 : 1	1: Failsafe relay operation (see table for relay logic) 0: Standard relay operation (default)
403	Warning Enabled	0 : 1	1: Warning threshold operation is enabled 0: Warning threshold operation is disabled (default)
404	Warning Activates Relay	0 : 1	1: Gas concentrations in excess of the Warning Threshold (Register 203) will activate the relay

Tab. 5.l

Note

CAREL

Agency:

"Gas Leakage Detector" +0300035EN - rel. 1.5 - 23.02.2015